

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-059784

(43)Date of publication of application : 03.03.1998

(51)Int.Cl.

C04B 38/00  
B01J 35/04  
F01N 3/28

(21)Application number : 08-229404

(71)Applicant : ISHIKAWAJIMA HARIMA HEAVY IND  
CO LTD

(22)Date of filing : 13.08.1996

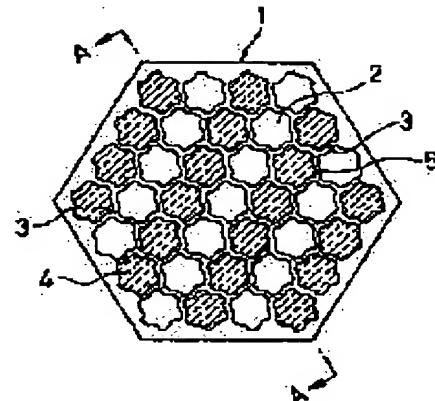
(72)Inventor : SUGITA TAKASHI  
OKA AKIHIRO

## (54) CERAMIC HONEYCOMB STRUCTURE

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a honeycomb structure in which generation of cracks due to thermal shock and mechanical vibration can be prevented and the filtration efficiency of which can be improved and for which various ceramic material can be used by forming partition walls that form each of cells of the honeycomb structure, so as to be porous curved-sheetlike or corrugated-sheetlike walls and also forming each of the cells so as to have a deformed hexagonal shape.

**SOLUTION:** This honeycomb structure 1 shown in the figure has an appropriate outer shape such as polygonal-prismatic or cylindrical shape and each of cells 2 has a shape surrounded by corrugated-sheetlike partition walls 3 each having gently corrugated surfaces 5. In the figure, each of the cells 2 has a hexagonal shape and high strength in the cross-sectional direction. As each of the corrugated surfaces 5, any corrugated surface can be used without special limitation, however, that having a sine-curved cross section is preferred and, as the raw material of the honeycomb structure 1, a cordierite or mullite ceramic material, or the like is preferably used. The ceramic honeycomb structure is a structure used as a carrier of an exhaust gas purifying catalyst. The number of the cells 2 is normally 280/in.2 (although the total number is only 37 in the figure) and each of the partition walls 3 has a 0.2mm thickness. Also, the honeycomb structure 1 has a 117mm outer size (outer diameter in the A-A direction) and a 150mm length.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

BEST AVAILABLE COPY

[Date of final disposal for application]  
[Patent number]  
[Date of registration]  
[Number of appeal against examiner's decision of rejection]  
[Date of requesting appeal against examiner's decision of rejection]  
[Date of extinction of right]

Copyright (C) 1998,2003 Japan Patent Office

\* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## CLAIMS

---

[Claim(s)]

[Claim 1] The honeycomb structure object made from the ceramics characterized by the septum (3) which constitutes each cel (2) of a honeycomb structure object (1) having the shape of a porous curved plate.

[Claim 2] The honeycomb structure object made from the ceramics according to claim 1 characterized by the shape of a curved plate being wave-front tabular.

[Claim 3] The honeycomb structure object made from the ceramics according to claim 1 or 2 characterized by being the hexagon which deformed each cel (2) of a honeycomb structure object (1).

---

[Translation done.]

\* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the honeycomb structure object made from the ceramics, and the honeycomb structure object made from the ceramics which turns into support

for catalysts etc. at a detail.

[0002]

[Description of the Prior Art] Conventionally the honeycomb structure object 1 used for the support for catalysts, a filter, etc. It is what consists of a cel 2 of a large number in which it was surrounded by the septum 3 of thin plate-like porosity as shown in drawing 5 and drawing 6 , and which end was confined by the ceramic \*\*\*\* material 4. It is a \*\*\*\*\* thing as discharged from the cel 2 which enters from the cel 2 in which the ceramic \*\*\*\* material 4 by the side of an inlet does not have exhaust gas etc., and does not have the ceramic \*\*\*\* material 4 by the side of an outlet through the porous septum 3. In order that \*\*\*\* energy might lessen, it was required for that the surface area which gases, such as exhaust gas per volume of a honeycomb structure object, pass is large in order for this honeycomb structure object 1 to improve clarification capacity, and aeration that there was little loss of the pressure of gases, such as exhaust gas. As one of the approaches which realizes these demands, the thickness of the septum of the whole honeycomb structure object containing the intersection of a septum was thinly constituted in homogeneity. However, since the septum was constituted thinly, the conventional honeycomb structure object had the fault that reinforcement was very low.

[0003] Moreover, the septum of the conventional honeycomb structure object consists of cels which the cross section as shown in drawing 5 R> 5 – drawing 8 connected in a straight line. The shape of a basic form of this cel was a square, a hexagon, a triangle, etc., and after carrying out extrusion molding also of any, it was calcined and manufactured. However, since the cel 2 was the thing of the configuration surrounded by the plate-like septum 3, the whole was a rigid structure and the conventional honeycomb structure object was structure which is easy to damage to a thermal shock and mechanical oscillation. Therefore, since the conventional honeycomb structure object had to manufacture using a ceramic ingredient with low coefficients of thermal expansion, such as cordierite, there was [ a fault that cost became high ]. Moreover, since the septum which constitutes the cel was plate-like, the inner circumference of each cel became the minimum die length, surface area became min as the result, and there was a fault that the effectiveness as a filter was low.

[0004]

[Problem(s) to be Solved by the Invention] The reinforcement of this invention of the direction of the cross section is higher than the conventional thing, and when reinforcement does not need to be high, it makes it a technical problem to consider the honeycomb structure object made from a ceramic of the structure which can also manufacture ceramic ingredients other than a ceramic ingredient with low coefficients of thermal expansion, such as cordierite, and can make a filtration area large as offer.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned technical problem, in the honeycomb structure object made from a ceramic of this invention, it is that the septum which constitutes each cel of a honeycomb structure object considered as the shape of a porous curved plate.

[0006] Moreover, in order to attain the above-mentioned technical problem, in the honeycomb structure object made from a ceramic of this invention, it is having made into the wave-front tabular thing the thing of the shape of a curved plate which constitutes each cel.

[0007] Moreover, in order to attain the above-mentioned technical problem, in the honeycomb structure object made from a ceramic of this invention, it is having made it the hexagon which deformed the configuration of each cel.

[0008]

[Embodiment of the Invention] It refers to a drawing and a configuration and an operation of this invention are explained. The appearance is carrying out proper configurations, such as the shape of cylindrical and a multiple column, the honeycomb structure object 1 made from the ceramics of this invention is carrying out the configuration surrounded by the wave-front tabular septum 3 which carried out the wave side 5 where each cel 2 is loose, as shown in drawing 1 – drawing 4 , and it makes all cels the same configuration. Moreover, since the reinforcement of the direction of the cross section (the vertical direction of drawing 2 ) is high, its thing of a hexagon is

desirable [ the configurations of each cel 2 of the honeycomb structure object 1 made from the ceramics of this invention are a hexagon, a square, a triangle, etc., as shown in drawing 1 , drawing 3 , and drawing 4 , but ].

[0009] Although especially the wave side 5 of the septum of this invention is not necessarily limited, its thing of the curve with which the cross section was similar to a sign curve or this is desirable. Moreover, the cordierite currently used from the former may be used for the raw material of the honeycomb structure object made from the ceramics of this invention, and other ceramic ingredients, such as non-oxide systems, such as oxide systems, such as quality of an alumina and quality of a mullite, silicon nitride, and silicon carbide, can be used for it. The ceramic ingredient with coefficients of thermal expansion low when these ceramic ingredients manufacture a honeycomb structure object with high reinforcement, such as cordierite, is suitable, and although reinforcement may be comparable as the former, when manufacturing what has low cost, ceramic ingredients, such as cheap quality of a mullite, can be used. Although fabricating by the extrusion method is appropriate for the honeycomb structure object made from the ceramics of this invention, other processes, such as baking, are the same as the approach currently performed ordinarily conventionally, and good. The dice for extrusion used for this extrusion method can be easily manufactured by NC machining, an electron discharge method, etc.

[0010]

[Function] Since the honeycomb structure object made from the ceramics of this invention is the thing of the configuration by which each cel is not plate-like and was surrounded by the curved plate-like septum, its rigidity of the direction of the cross section is low, namely, since a septum is a curved plate-like, it tends to bend from a plate-like thing, and is supple. Although this can say it also in each cel, it is more remarkable as the whole. So, when it considers as the filter for elevated-temperature exhaust gas, it distributes, the generating stress of the configuration member by the thermal shock and mechanical oscillation declines, and its generating of a crack decreases. Moreover, since the septum of each cel is a curve (curved surface), surface area becomes larger than a linear (flat surface) thing, and the honeycomb structure object made from the ceramics of this invention can increase a filtration area.

[0011]

[Example] Hereafter, each example of a graphic display is explained. What was shown in drawing 1 R>1 and drawing 2 is a honeycomb structure object made from a ceramic used for the support of the exhaust gas clarification catalyst of the 1st example of this invention. A periphery cross-section configuration is a hexagon and this honeycomb structure object 1 is the thing of a configuration by which the cross section of each cel 2 was divided in the shape of a hexagon by the wave-front tabular septum 3 which has the wave side 5. This wave side 5 is the configuration which made the sign curve gently-sloping. The number of cels is 150mm in 280 0.2mm in 2 (although it is 37 pieces in drawing 1 since the cel is expanded and indicated, it is this number that carries out actual manufacture.), and thickness of a septum 3/inch, 117mm (the direction of A-A) of appearances, and die length.

[0012] Manufacture of this honeycomb structure object 1 made from the ceramics kneads cordierite powder or mullite powder, water, and an organic binder, and carries out extrusion molding by the usual approach except using the dice for extrusion of the configuration where it was made for a septum to become wave-front tabular. When putting the ceramic \*\*\*\* material 4 in one side of each cel after that, and using cordierite powder after drying, it can calcinate at 1370-1400 degrees C for 12 hours, and expected support can be obtained.

[0013] What was shown in drawing 3 is some circular honeycomb structure objects made from the ceramics used for the support of the exhaust gas clarification catalyst of the 2nd example of this invention. This honeycomb structure object is the thing of a configuration by which each cel 2 was divided in the shape of a square by the wave-front tabular septum 3 which has the wave side 5. The number of cels is 150mm in 0.2mm in 2 and thickness of a septum 3 of 300 pieces/inch, the diameter of 117mm of an appearance, and die length. Manufacture of this honeycomb structure object 1 made from the ceramics can be manufactured by the same approach as an example 1 except the dices for extrusion differing.

[0014] What was shown in drawing 4 is some honeycomb structure objects made from the ceramics used for the support of the exhaust gas clarification catalyst of the 3rd example of this invention. This honeycomb structure object is the thing of the configuration divided in the shape of a triangle by the wave-front tabular septum 3 by which each cel 2 has the wave side 5. The number of cels is 150mm in 0.2mm in 2 and thickness of a septum 3 of 320 pieces/inch, the diameter of 117mm of an appearance, and die length. Manufacture of this honeycomb structure object 1 made from the ceramics can be manufactured by the same approach as an example 1 except the dices for extrusion differing.

[0015]

[Effect of the Invention] This invention does the following outstanding effectiveness so by having made it the above-mentioned configuration.

- (1) The honeycomb structure object made from the ceramics of this invention can prevent generating of the crack by the thermal shock and mechanical oscillation.
- (2) Since specific surface area becomes large as compared with the honeycomb structure object which has the same content volume and passage resistance becomes small, effectiveness, such as filtration, becomes high.
- (3) Limited ceramic raw material chisel \*\* and various kinds of ceramic ingredients can be used.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

#### DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the front view to which the cel of the honeycomb structure object made from the ceramics of one example of this invention was expanded.

[Drawing 2] It is the A-A sectional view of the thing of drawing 1.

[Drawing 3] They are some amplification front views of the honeycomb structure object made from the ceramics of other examples of this invention.

[Drawing 4] They are some front views of the honeycomb structure object made from the ceramics of other examples of this invention.

[Drawing 5] It is the front view of the conventional honeycomb structure object made from the ceramics.

[Drawing 6] It is the B-B sectional view of the thing of drawing 5.

[Drawing 7] It is the front view of other conventional honeycomb structure objects made from the ceramics.

[Drawing 8] It is the front view of other conventional honeycomb structure objects made from the ceramics.

[Description of Notations]

1 Honeycomb Structure Object made from Ceramics

2 Cel

3 Septum

4 Ceramic \*\*\*\* Material

## 5 Wave Side

---

[Translation done.]

## \* NOTICES \*

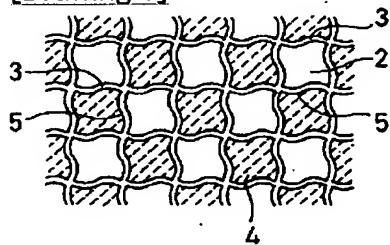
JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

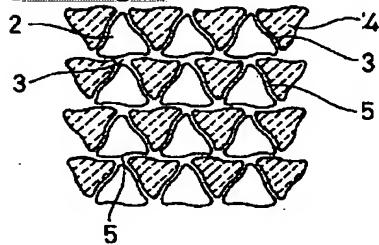
---

DRAWINGS

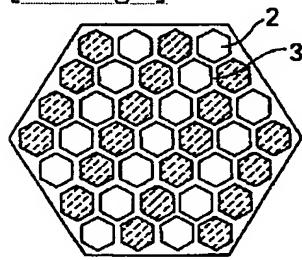
## [Drawing 3]



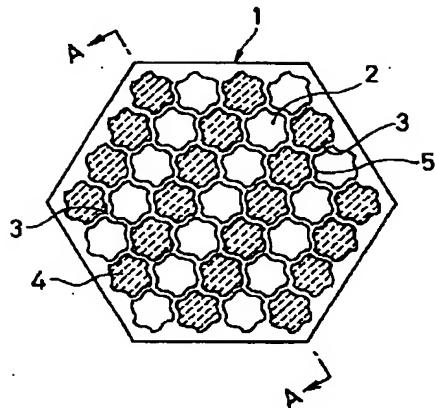
## [Drawing 4]



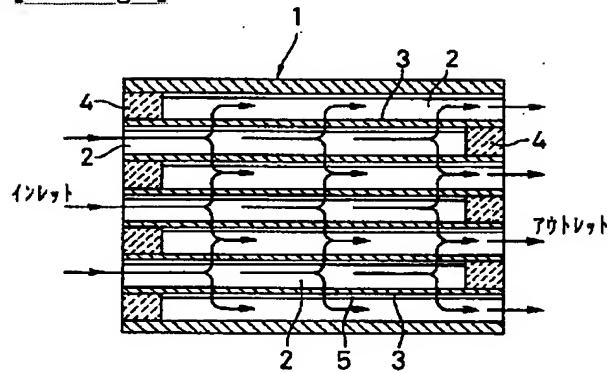
## [Drawing 7]



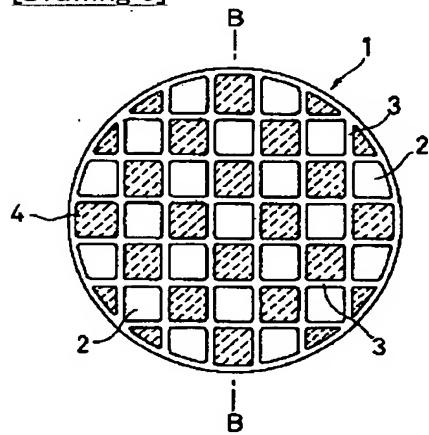
## [Drawing 1]



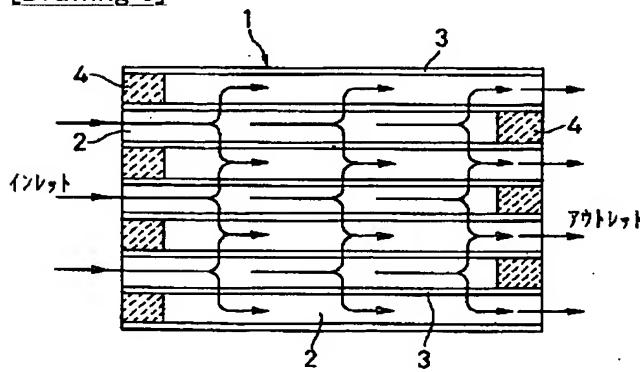
[Drawing 2]



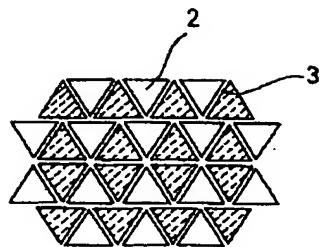
[Drawing 5]



[Drawing 6]



[Drawing 8]



---

[Translation done.]

## 引用例 5

(10) 日本国特許庁 (J-P)

## (12) 公開特許公報 (A)

(11) 特許出願公開番号:

特開平10-59784

(13) 公開日: 平成10年(1998)3月8日

(51) Int. CL <sup>6</sup>	類別記号	序文登録番号	F.I.	技術表示箇所
C04B 35/00	3.0.8	C04B 35/00	3.0.8.Z	
B01J 35/04	3.0.1	B01J 35/04	3.0.1.C	
F01N 3/28	3.0.1	F01N 3/28	3.0.1.R	

審査請求 未請求 請求項の数 3 FD (全 4 頁)

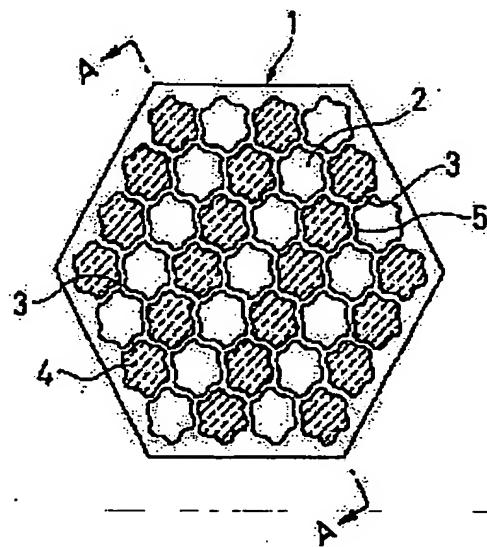
(21) 出願番号: 特願平9-229404	(71) 出願人: 000000099 石川島播磨重工業株式会社 東京都千代田区大手町2丁目2番1号
(22) 出願日: 平成9年(1997)8月18日	(72) 発明者: 伊田 季吉 東京都江東区豊洲3-1-15 石川島播磨 重工業株式会社技術研究所内
	(73) 発明者: 田中 宏 東京都江東区豊洲3-1-15 石川島播磨 重工業株式会社技術研究所内
	(74) 代理人: 弁理士: 朝日: 鳥美

(54) [発明の名称] セラミックス製ハニカム構造体

## (57) [要約]

【課題】 従来のものより横断面方向の強度が高く、強度が高くなくてもよい場合には、コーナーライトなどの熱膨張係数の低いセラミック材料以外のセラミック材料でも製造することができ、また減面積を広くすることができる構造のセラミックス製ハニカム構造体を提供すること。

【解決手段】 セラミックス製ハニカム構造体1の各セル2を構成している隔壁3が多孔質の曲面板状であること。



#### 【特許請求の範囲】

【請求項1】ハニカム構造体(1)の各セル(2)を構成している隔壁(3)が多孔質の曲面板状であることを特徴とするセラミックス製ハニカム構造体。

【請求項2】曲面板状が波面板状であることを特徴とする請求項1記載のセラミックス製ハニカム構造体。

【請求項3】ハニカム構造体(1)の各セル(2)が変形した六角形であることを特徴とする請求項1又は請求項2記載のセラミックス製ハニカム構造体。

#### 【発明の詳細な説明】

##### 【0.0.0.1】

【発明の属する技術分野】本発明は、セラミックス製ハニカム構造体、詳細には触媒用担体などになるセラミックス製ハニカム構造体に関する。

##### 【0.0.0.2】

【従来の技術】従来、触媒用担体、フィルターなどに用いられるハニカム構造体<sup>1</sup>は、図5および図6に示すように薄い平板状の多孔質の隔壁3で囲まれ、何れかの一端がセラミック自封じ材4で封しられた多孔のセル2からなるもので、排気ガスなどがインレット側のセラミック自封じ材4がないセル2から入り、多孔質の隔壁3を通過してアウトレット側のセラミック自封じ材4がないセル2から排出されるようになっているものである。このハニカム構造体<sup>1</sup>は、導化能力を向上するため、ハニカム構造体の体積当たりの排気ガスなどの気体から通過する表面積が大きいこと、および熱気に要するエネルギーが少なくするため、排気ガスなどの気体の圧力の損失が少ないことが要求されていた。これらの要求を実現する方法の一つとして、隔壁の交差部を含むハニカム構造体全体の隔壁の厚さを均一に薄く構成していた。しかし、従来のハニカム構造体は、隔壁が薄く構成されていたため、強度が非常に低いという欠点があった。

【0.0.0.3】また、従来のハニカム構造体の隔壁は、図5～図6に示すような断面が直線で結んだセルで構成されている。このセルの基本形状は、四角形、六角形、三角形などであり、いずれも押し出し成形した後焼成して製造していた。しかし、従来のハニカム構造体は、そのセル2が平板状の隔壁で囲まれた形状のものであるので、全体が剛構造であり、熱衝撃、機械的振動に対して破損し易い構造であった。そのため、従来のハニカム構造体は、コーナーライトなどの熱膨張係数の低いセラミックス材料を用いて製造しなければならなかった。コストが高くなるという欠点があった。また、セルを構成している隔壁が平板状であるため、各セルの内周が最小長さになり、その結果として表面積が最小となり、フィルターとしての効率が低いという欠点があった。

##### 【0.0.0.4】

【発明が解決しようとする課題】本発明は、従来のものより横断面方向の強度が高く、強度が高くななくてもよい場合には、コーナーライトなどの熱膨張係数の低いセラ

ミック材料以外のセラミック材料でも製造することができ、また通過面積を広くすることができる構造のセラミックス製ハニカム構造体を提供することを課題とするものである。

##### 【0.0.0.5】

【課題を解決するための手段】上記課題を達成するため、本発明のセラミックス製ハニカム構造体においては、ハニカム構造体の各セルを構成している隔壁が多孔質の曲面板状としたことである。

【0.0.0.6】また、上記課題を達成するため、本発明のセラミックス製ハニカム構造体においては、各セルを構成する曲面板状のものを波面板状のものとしたことである。

【0.0.0.7】また、上記課題を達成するため、本発明のセラミックス製ハニカム構造体においては、各セルの形状を変形した六角形にしたことである。

##### 【0.0.0.8】

【発明の実施の形態】本発明の構成および作用を図面を参考にして説明する。本発明のセラミックス製ハニカム構造体<sup>1</sup>は、外形が円筒状、多角柱状などの適宜の形状をしており、図1～図4に示すように各セル2が複数やかな波形面5をした波面板状の隔壁3で囲まれた形状をしており、また全てのセルを同じ形状にしたものである。また、本発明のセラミックス製ハニカム構造体<sup>1</sup>の各セル2の形状は、図1、図3及び図4に示したように六角形、四角形、三角形などであるが、横断面方向(図2の上下方向)の強度が高いことから六角形のものが好ましい。

【0.0.0.9】本発明の隔壁の波形面5は、特に限定されるわけではないが、横断面がサインカーブ又はこれに類似した曲線のものが好ましい。また、本発明のセラミックス製ハニカム構造体の原料は、従来から使用されているコーナーライトを使用してもよいし、アルミニウム、ムライト質などの酸化物系、空化ケイ素、炭化ケイ素などの非酸化物系などの他のセラミック材料も使用することができる。これらのセラミック材料は、強度が高いハニカム構造体を製造する場合には、コーナーライトなどの熱膨張係数の低いセラミック材料が適しており、強度は従来と同程度でよいが、コストが低いものを製造する場合には、安価なムライト質などのセラミック材料を使うことができる。本発明のセラミックス製ハニカム構造体は、押出し法で成形するのが適当であるが、成形などの他の工程は従来普通に行われている方法と同じでよい。この押出し法に使用する押出し用ダイスは、NC加工、放電加工などで容易に製造することができる。

##### 【0.0.1.0】

【作用】本発明のセラミックス製ハニカム構造体は、各セルが平板状でなくして曲面板状の隔壁で囲まれた形状のものであるため、横断面方向の剛性が低く、すなわち隔壁が曲面板状であるため、平板状のものより焼み易く、

柔軟性がある。このことは各セルでもそれが言えるが、全体としてはより剛性になっている。それ故に、高温排気ガス用のフィルターとした場合、熱衝撃、機械的振動による構成部材の発生応力は分散されて低下し、クラックの発生が少なくなる。また、本発明のセラミックス製ハニカム構造体は、各セルの隔壁が曲線（曲面）であるので、表面積が直線（平面）のものより大きくなり、通過圧を増加することができる。

【0011】

【実施例】以下、図示の各実施例について説明する。図1および図2に示したもののは本発明の第1の実施例の排気ガス浄化触媒の担体に使用するセラミックス製ハニカム構造体である。このハニカム構造体1は、外周断面形状が六角形で、各セル2が波形面5を有する波面板状の隔壁3で三角形状に区画された形状のものである。セルの数は320個／1n2、隔壁3の厚さ0.2mm、外形の直径1.17mm、長さ15.0mmである。このセラミックス製ハニカム構造体1の製造は、押出し用ダイスが異なること以外は実施例1と同様な方法で製造することができる。

【0012】このセラミックス製ハニカム構造体1の製造は、コーチェライト粉末またはムライト粉末、水および有機バインダーを混練し、隔壁が波面板状になるようにした形状の押出し用ダイスを用いること以外は通常の方法で押し出し成形する。その後各セルの一方にセラミック自封じ材4を詰め、乾燥した後コーチェライト粉末を用いる場合には137.0～140.0℃で12時間焼成して所期の担体を得ることができる。

【0013】図3に示したものは本発明の第2の実施例の排気ガス浄化触媒の担体に使用する円形のセラミックス製ハニカム構造体の一部である。このハニカム構造体は、各セル2が波形面5を有する波面板状の隔壁3で四角形状に区画された形状のものである。セルの数は300個／1n2、隔壁3の厚さ0.2mm、外形の直径1.17mm、長さ15.0mmである。このセラミックス製ハニカム構造体1の製造は、押出し用ダイスが異なること以外実施例1と同様な方法で製造することができる。

【0014】図4に示したものは本発明の第3の実施例

の排気ガス浄化触媒の担体に使用するセラミックス製ハニカム構造体の一部である。このハニカム構造体は、各セル2が波形面5を有する波面板状の隔壁3で三角形状に区画された形状のものである。セルの数は320個／1n2、隔壁3の厚さ0.2mm、外形の直径1.17mm、長さ15.0mmである。このセラミックス製ハニカム構造体1の製造は、押出し用ダイスが異なること以外は実施例1と同様な方法で製造することができる。

【0015】

【発明の効果】本発明は、上記構成にしたことにより、次のような効れた効果を奏する。

(1) 本発明のセラミックス製ハニカム構造体は、熱衝撃および機械的振動によるクラックの発生を防止することができる。

(2) 同一の内容積を有するハニカム構造体と比較して比表面積が大きくなり、流路抵抗が小さくなるので、通過などの効率が高くなる。

(3) 限定したセラミックス原料のみらず、各種のセラミックス材料を使用することができる。

【図面の簡単な説明】

【図1】本発明の一実施例のセラミックス製ハニカム構造体のセルを拡大した正面図である。

【図2】図1のもののA-A断面図である。

【図3】本発明の他の実施例のセラミックス製ハニカム構造体の一部の拡大正面図である。

【図4】本発明の他の実施例のセラミックス製ハニカム構造体の一部の正面図である。

【図5】従来のセラミックス製ハニカム構造体の正面図である。

【図6】図5のもののB-B断面図である。

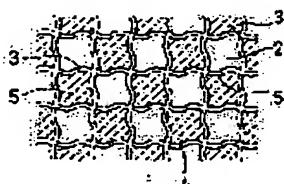
【図7】従来の他のセラミックス製ハニカム構造体の正面図である。

【図8】従来の他のセラミックス製ハニカム構造体の正面図である。

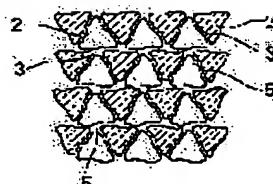
【符号の説明】

- 1 セラミックス製ハニカム構造体
- 2 セル
- 3 隔壁
- 4 セラミック自封じ材
- 5 波形面

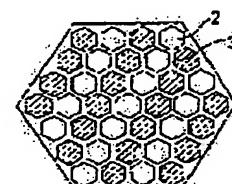
【図3】



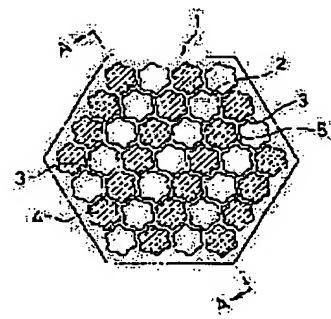
【図4】



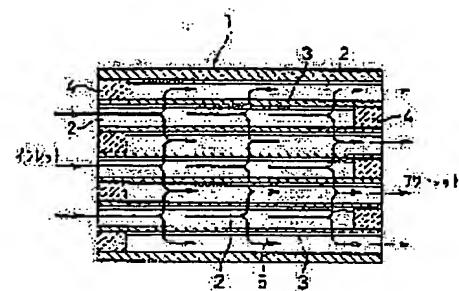
【図7】



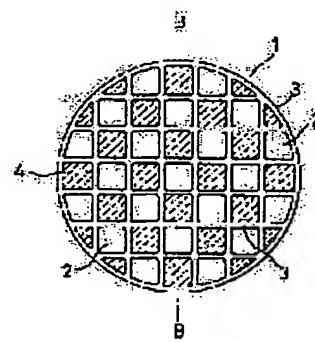
〔図1〕



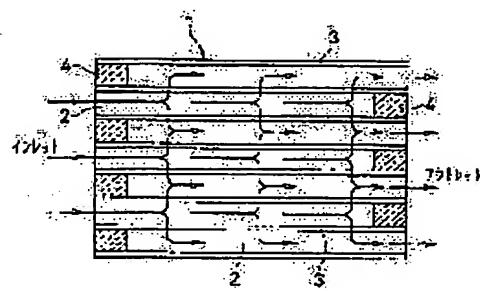
〔図2〕



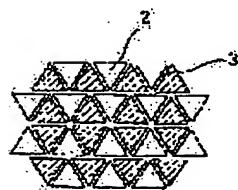
〔図5〕



〔図6〕



〔図8〕



**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER: \_\_\_\_\_**

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**